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**To cite this article:** Yasuharu Shimamura, Satoshi Shimizutani, Eiji Yamada & Hiroyuki Yamada (2023) The Gendered Impact of Rural Road Improvement on Schooling Decisions and Youth Employment in Morocco, The Journal of Development Studies, 59:3, 413-429, DOI: [10.1080/00220388.2022.2139608](https://doi.org/10.1080/00220388.2022.2139608)

**To link to this article:** <https://doi.org/10.1080/00220388.2022.2139608>



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# The Gendered Impact of Rural Road Improvement on Schooling Decisions and Youth Employment in Morocco

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(Original version submitted February 2022; final version accepted October 2022)

**ABSTRACT** *This paper examines the impact of a rural road improvement project on schooling decisions and youth employment in Morocco. Paved rural roads are expected to reduce travel time and costs, allowing additional school choices and increasing the motivation for youth to enter higher education. On the other hand, immediate earning opportunities created by new connections may encourage youth to seek paid employment. Thus, the impact of rural road improvement on schooling and youth employment warrants empirical investigation. We employ a difference-in-differences estimation using a household-level dataset collected under a quasi-experimental setting. First, we do not observe any positive effect on primary school completion for either sex, but we find a positive and significant effect on secondary school attainment or above for females. Moreover, the higher educational attainment of females is associated with a lower proportion of early marriage. Second, we do not observe any significant effects on self-employment for either sex, but we find a positive and significant effect on wage employment for males, which is pronounced among the better educated. Our findings reveal sharp gendered differences in the impact of the rural road improvement project, with increased motivation towards better education for females and paid work for males.*

**KEYWORDS:** Rural road improvement; schooling outcomes; youth employment; market integration; Morocco; gender

**JEL CLASSIFICATION CODES:** I25; O18; J24

## 1. Introduction

Access to transportation infrastructure is essential for daily life, serving as a driving force for economic development. However, inadequate provision of transportation infrastructure

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Supplementary Materials are available for this article which can be accessed via the online version of this journal available at <https://doi.org/10.1080/00220388.2022.2139608>

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continues to pose serious policy challenges for countries in Africa, as Rural Access Index (RAI) rankings indicate.<sup>1</sup> Much of Africa's road network, the predominant mode of transport, remains unpaved, preventing people from accessing basic education, health services, transport and trade, and economic opportunities (African Development Bank, 2018). While wide variations in transport accessibility can be seen across countries in Africa (Africa Infrastructure Development Index), access to transportation infrastructure in rural areas is particularly impaired where the majority of smallholder farmers suffer from limited connections with outside markets, and many poorer people endure limited access to social services (e.g. Kiprono & Matsumoto, 2018).

This study examines the impact of a rural road improvement project on schooling outcomes and youth employment in Morocco. Despite substantive efforts being made over the past several decades, there have been calls for the upgrading of rural roads in Morocco. Limited access to road infrastructure impedes economic opportunities and social services provision in rural areas. Moreover, the country suffers from lower educational enrolment, particularly in post-primary education for girls in rural areas. This can be partly attributed to poor road infrastructure (Japan International Cooperation Agency [JICA], 2011). Under these circumstances, rural road improvement is expected to favourably affect both schooling and work decisions among youth.

However, the impact of rural road improvement on schooling outcomes and youth employment is *a priori* indeterminate and calls for empirical investigation (Adukia, Asher, & Novosad, 2020). The improvement of road transportation is expected to reduce travel time and costs as well as expand the availability of transport options. As a result, access to improved roads may increase students' school choices, which is critical for decisions to advance beyond primary school education. Moreover, people living in rural areas may gain access to outside markets and enjoy new employment opportunities. New connections to markets may encourage educational attainment if they increase financial returns from education. If this is the case, households will be motivated to invest more in human capital to seek higher educational attainment (Adukia et al., 2020).

On the other hand, integration with outside markets through new connections may activate local economic development and create new jobs in rural areas (Aggarwal, 2018). Renewed rural roads may create new wage employment opportunities by transforming agricultural production and creating small businesses. Furthermore, renewed rural roads may create new employment opportunities through access to outside markets. Hence, the transformation of regional economic activities may lead to new immediate employment opportunities in rural areas. As opportunity costs for schooling are higher than before, youth may choose to take an earlier exit from school to obtain a paid job. If this is the case, road improvements may crowd out educational investment in rural areas (Aggarwal, 2018).

In comparison to the large volume of literature on new connections to international markets, the impacts of domestic market integration have been studied less.<sup>2</sup> Among the limited available literature, some studies have found that better accessibility has a positive effect on education outcomes in terms of increasing school attendance, improved school choices and school completion rates in Morocco (Levy, Voyadzis, & Volonte, 1996), Vietnam (Mu & van de Walle, 2007), Nigeria (Porter, 1997), and India (Mukherjee, 2012). Moreover, Khandker, Bakht, and Koolwal (2009) and Khandker and Koolwal (2011) showed that small-scale road construction is associated with a higher school enrolment in Bangladesh. On the other hand, other studies found no significant effect in Ghana (Hine, Riverson, & Kwakye, 1983) or Vietnam (Cuong, 2011).<sup>3</sup>

Recently, Aggarwal (2018) used district-level data in India to show that rural roads enhance school enrolment for younger children, while teenagers are motivated to drop out of school and join the labour force as urban markets become accessible. Adukia et al. (2020) found that children are more likely to stay in school longer and perform better on standardised exams in India. They argue that a standard human capital investment model supports their finding: school enrolment increases most when nearby labour markets offer high returns to education.

A central concern for the empirical analysis is the crowding out of higher education: the trade-off for individuals between long-run investment in human capital and immediate economic opportunities. In order to interrogate this concern, this study utilises a unique dataset collected in a quasi-experimental setting during the 2010s in Morocco. The data consist of a panel sample of households that gained access to all-weather roads through a road improvement project and households that remained inaccessible to paved roads. We employ a difference-in-differences (DID) estimation to explore the impact of rural road improvement on schooling outcomes and youth employment during the period.

We attempt to contribute to the literature in three ways. First, we provide evidence on the impact of rural road improvement in a country where gender disparities in educational and economic opportunities are large. In Morocco, females face greater restrictions on opportunities to attain higher education or employment than males (High Commission for Planning of the Kingdom of Morocco, 2021; International Labour Organization, 2018). Thus, we focus on the difference in the impact of rural road improvement between young females and males, which may shed light on the gendered impacts of infrastructure on beneficiaries. Moreover, to our knowledge, there has been a small volume of recent papers which examined the impact of road pavement in Africa, which is the case for educational outcomes. Second, we examine the impact of community road improvement in rural areas, a field that has been largely neglected in the literature in contrast to many studies on the impact of highways and their feeder roads. This study focusses on residential roads dispersed over rural areas, including the coastal and mountainous areas that are relevant to decisions on schooling and employment for youth. Third, we utilise rich household-level data to provide new evidence on the impact of rural road improvement, allowing us to identify the impact after controlling for heterogeneity of households. Our dataset contains rich information on the characteristics of individuals, households, and villages, and the negligible attrition rate enhances the precision of our estimates.

Our empirical results show that road improvement has a positive and significant impact on youth, which differs between males and females. For young females, access to paved roads encouraged them to advance to secondary school or above. Higher educational attainment is also associated with a decline in early marriage, suggesting that improved road access has eased commuting to secondary schools or above and led young females to postpone marriage. In contrast, for young males, rural road improvement did not motivate them to pursue a better education. Instead, young males exploited new employment opportunities to enjoy a significantly higher chance of finding wage employment and the impact is larger for better educated males. In summary, we show the heterogeneous impact of road access improvement across gender, reflecting the difference in return on education between females and males.

This article is comprised of the following sections. The next section describes the target project and the research design. [Section 3](#) explains the dataset, and [Section 4](#) describes our empirical strategy. [Section 5](#) shows the estimation results, and [Section 6](#) provides those using alternative analyses. We discuss the findings in [Section 7](#). The final section summarises our main findings and offers some considerations for future research.

## **2. The project and research design**

With a population of 37 million in 2020, Morocco is located in the west of the Maghreb region of North Africa that looks towards both the Mediterranean Sea and the Atlantic Ocean. The transportation sector occupies a substantial portion of economic activities in the country, accounting for 6 per cent of its total GDP, creating 10 per cent of urban employment and contributing 15 per cent of national tax revenue (JICA, 2011). However, until recently, there was a substantial gap in transportation activities between urban and rural areas. At the beginning of the 2010s, more than 80 per cent of major roads in the country, such as highways and national/state roads, were paved, and road transportation conveyed 90 per cent of intercity land

passengers and 75 per cent of intercity land freight (JICA, 2019). In contrast, the development of rural road infrastructure was slow: only 62 per cent of prefectural roads were paved in 2009, and only 54 per cent of the rural population enjoyed access to road infrastructure (JICA, 2011).<sup>4</sup>

The large economic disparity between urban and rural areas has been a major challenge for Morocco, where the latest rural poverty headcount ratio is 36.8 per cent against 6.4 per cent for urban areas in 2019 (National Observatory of Human Development, 2021). For decades, the government has placed a top priority on reducing disparities between urban and rural areas, a goal repeatedly stated in the country's five-year economic development plans. The government acknowledged that the limited access to road infrastructure was an impediment to economic opportunities and social services provision in rural areas and that rural economic activities can be activated through rural road improvement and better access to transportation services for remote populations (JICA, 2011).

Under these circumstances, the government launched the National Rural Roads Plan (Plan National des Routes Rurales: PNRR) I in 1995 and improved rural roads by 11,200 km to increase rural road accessibility to 50 per cent in 2005. Subsequently, the government began to implement the National Rural Roads Plan II in 2005, aiming to improve 15,500 km of rural roads to ensure that 80 per cent of the rural population had access to the paved road network by 2012.

In addition to economic indicators, urban-rural inequality is predominant among social indicators and prominently observed in school attainment. In Morocco, compulsory education starts at the official age of 6 and covers both primary (age 6 to 11) and junior secondary education (age 12 to 14). This is followed by senior secondary (age 15 to 17) and tertiary education (age 18 and over). The enrolment rate for primary education has gradually increased from 93.2 per cent in 2011 to 99.5 per cent in 2019.<sup>5</sup> The enrolment rate for secondary education also increased from 53.8 per cent in 2011 to 66.2 per cent in 2019.

However, there is a large discrepancy in school enrolment by region. Among primary-school-age children, 4 per cent of rural children were not enrolled, compared to 1 per cent in urban areas, and the exclusion rate in rural children was higher for girls (UNICEF, 2014). Among children in the junior secondary-school age, 16 per cent were not in primary or secondary school, and the exclusion rate exceeded 30 per cent for rural children. Moreover, 11 per cent of rural children in this age group were working, contrasting to only 1 per cent for children living in urban areas.

Furthermore, the educational disparity by gender among rural youth is large, especially in secondary education. Girls comprise 78 per cent of children excluded from junior secondary education in rural areas. According to the High Planning Commission (Haut-Commissariat au Plan), in 2016, 14.8 per cent of rural women aged 15–24 years old were illiterate against 7.2 per cent for the rural men in the same age range. Furthermore, the proportion of NEET (Not in Education, Employment, or Training) among rural women of 15–24 years old was 44 per cent, almost four times that of men. Young rural women tend to marry earlier; the average age of first marriage is 25.5 years old for women and 29.5 years old for men (LANDINFO, 2017).

Given this harsh reality, the Japan International Cooperation Agency (JICA) has supported rural road improvement initiatives in the National Rural Roads Plan II through two concessional loans ('Rural Road Improvement Project' I and II), expecting to improve the living standards of the rural population and stimulate the rural economy by ensuring access to road infrastructure.<sup>6</sup> The Rural Road Improvement Project II, the target of this study, financed the improvement of rural roads (530 km in total) in five provinces (Al Hauze, Chefchaouen, Essaouira, Safi, and Settat). The project paves 30 sections of rural unpaved roads (on average 17.7 km per section) and widens the roads to allow two-way traffic so that more than 163,000 people in rural areas can gain access to an all-weather road (JICA, 2011). The construction work commenced at different times depending on the section. The first work started in 2012

and the last in 2014. The construction period also varies, and the final construction work related to this study was completed in June 2016. The population started to use each road once construction work was completed. Before the road improvement project started, the pre-existing unpaved road systems in rural areas were subject to frequent road closures in the rainy season. Access to secondary school or above was more severely hampered by road conditions than access to the primary schools located in the village. The project improved pavement and widened the roads so that larger vehicles could drive at higher speeds.

### 3. Data description

In the Rural Road Improvement Project II, 30 of the target (treatment) roads to be constructed or rehabilitated were selected as follows. First, the provincial offices of ‘Direction des Routes’ (Roads Directorate within the Ministry of Equipment, Transport, Logistics, and Water) in each of five provinces prepared a priority list of potential roads to be constructed. The selection criteria included the size of the population covered by each road as well as the number of markets, schools, and health facilities along roads and connectivity to existing road networks (JICA, 2019). The list was scrutinised by communal and provincial governments and the Ministry assemblies to accommodate local needs and preferences. The participation of local authorities was crucial to ensure the sustainability of the roads since communes are responsible for the maintenance of roads after construction.

The target (treatment) roads for data collection were drawn from this list by JICA, considering the preparedness of the construction plan, coverage of other donors, and the necessity of land acquisition and/or resettlements. Among the 30 roads JICA selected for the project, 17 treatment roads were identified for the survey. Then, comparison (control) roads that were not improved were selected. The ‘Direction des Routes’ in each province listed several roads that were most similar to the target roads based on the same criteria considered in the selection process of the target roads. Among these listed roads, the candidates for comparison roads were further identified by the evaluation team. Finally, 18 control roads were identified.

We provide a detailed description of the data and definitions of treatment and control groups in the [Supplementary Materials](#). We conducted the baseline survey in 2011 and the end-line in 2017. The primary sampling unit (PSU) was ‘douar’, a cluster of houses (small villages) in a rural area. The catchment area of each road is defined as an area within a 1 km distance from either side of the road. For each road, five villages were randomly selected in the catchment and 10 households were randomly selected in each village. The number of villages in the treatment road areas was 76 from 27 communes, with 70 from 21 communes in the control road areas. The number of households in the treatment group was 760 in the baseline survey and 748 in the end-line survey. The number of households in the control group was 694 in the baseline survey and 669 in the end-line survey. The attrition rate is surprisingly negligible given the five-year interval, 1.6 per cent for the treatment group and 3.6 per cent for the control group. In order to detect selection into attrition, we regressed a binary variable to take 1 for those that dropped off and 0 otherwise on the covariates at the household level and found that no coefficients are significant. We also found that there is no significant difference in the outcome variables between those that dropped and those that did not. These results show that there is no specific pattern in the attrition.

We employ two definitions of treatment and control groups using two thresholds: 2 km and 5 km from the roads. The thresholds are arbitrary but we succeed in splitting the households into treatment and control groups through the balance test (see [Table 1](#)). We also confirm that the main results do not depend on the choice of the threshold. We perform the analyses based on these two definitions below.

[Table 1](#) provides a balance test of the outcome variables at the baseline before the intervention of the project to compare the variables used in the estimation between the treatment and

Table 1. Balance test of outcome variables

|                              | Treatment (within 2 km) |                    |                   |         | Treatment (within 5 km) |                    |                   |         |
|------------------------------|-------------------------|--------------------|-------------------|---------|-------------------------|--------------------|-------------------|---------|
|                              | Treatment groups (A)    | Control groups (B) | Diff. (A)–(B) (C) | SE (D)  | Treatment groups (E)    | Control groups (F) | Diff. (E)–(F) (G) | SE (H)  |
| School attendance (=1)       |                         |                    |                   |         |                         |                    |                   |         |
| Girls aged 7 to 18           | n = 311<br>0.595        | n = 203<br>0.542   | 0.053             | (0.045) | n = 393<br>0.598        | n = 255<br>0.565   | 0.033             | (0.040) |
| Boys aged 7 to 18            | n = 338<br>0.692        | n = 222<br>0.703   | –0.010            | (0.040) | n = 439<br>0.699        | n = 253<br>0.684   | 0.016             | (0.036) |
| Primary completion (=1)      |                         |                    |                   |         |                         |                    |                   |         |
| Girls aged 13 to 18          | n = 141<br>0.411        | n = 98<br>0.408    | 0.003             | (0.065) | n = 184<br>0.435        | n = 124<br>0.411   | 0.023             | (0.058) |
| Boys aged 13 to 18           | n = 174<br>0.609        | n = 111<br>0.658   | –0.048            | (0.059) | n = 220<br>0.591        | n = 127<br>0.646   | –0.055            | (0.054) |
| Some secondary or above (=1) |                         |                    |                   |         |                         |                    |                   |         |
| Females aged 13 to 25        | n = 360<br>0.139        | n = 228<br>0.101   | 0.038             | (0.028) | n = 494<br>0.154        | n = 265<br>0.132   | 0.022             | (0.027) |
| Males aged 13 to 25          | n = 408<br>0.360        | n = 229<br>0.306   | 0.055             | (0.039) | n = 532<br>0.346        | n = 250<br>0.332   | 0.014             | (0.036) |
| Self-employment (=1)         |                         |                    |                   |         |                         |                    |                   |         |
| Females aged 16 to 25        | n = 294<br>0.017        | n = 175<br>0.006   | 0.011             | (0.011) | n = 404<br>0.012        | n = 204<br>0.010   | 0.003             | (0.009) |
| Males aged 16 to 25          | n = 316<br>0.418        | n = 163<br>0.368   | 0.050             | (0.047) | n = 417<br>0.451        | n = 176<br>0.398   | 0.053             | (0.045) |
| Wage employment (=1)         |                         |                    |                   |         |                         |                    |                   |         |
| Females aged 16 to 25        | n = 294<br>0.007        | n = 175<br>0.006   | 0.001             | (0.008) | n = 404<br>0.007        | n = 204<br>0.010   | –0.002            | (0.008) |
| Males aged 16 to 25          | n = 316<br>0.335        | n = 163<br>0.429   | –0.094**          | (0.046) | n = 417<br>0.317        | n = 176<br>0.415   | –0.098**          | (0.043) |
| Marriage (=1)                |                         |                    |                   |         |                         |                    |                   |         |
| Females aged 14 to 25        | n = 341<br>0.396        | n = 212<br>0.377   | 0.019             | (0.043) | n = 468<br>0.385        | n = 246<br>0.346   | 0.039             | (0.038) |
| Males aged 14 to 25          | n = 372<br>0.078        | n = 210<br>0.114   | –0.036            | (0.025) | n = 488<br>0.084        | n = 231<br>0.091   | –0.007            | (0.022) |

Note: t-test results are shown (Fisher's exact test also supports the results): \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.



control groups. We employ different age groups for different outcomes since the age group that is supposed to be most affected depends on outcomes. First, we see the balance of the schooling outcomes at the time of the baseline survey. School attendance for girls aged 7 to 18 is 59 per cent for the treatment group and 54 per cent for the control group when setting the threshold as 2 km and that for boys is 69 per cent for the treatment and 70 per cent for the control groups. The differences of those variables between treatment and control groups are not statistically significant. The figures are comparable when we take the other threshold as 5 km, and we do not see any statistical difference between the treatment and control groups.

Furthermore, we take two forms of educational attainment outcomes. The proportion of primary school completion for girls aged 13 to 18 is 41 per cent for both the treatment and control groups, and that for boys aged 13 to 18 is 61 per cent for the treatment group and 66 per cent for the control group when the threshold is 2 km. The proportion of having ever attained secondary school or above for females aged 13 to 25 is 14 per cent for the treatment group and 10 per cent for the control group, while that for young males aged 13 to 25 is 36 per cent for the treatment group and 31 per cent for the control group. The difference of those variables is not statistically significant between treatment and control groups, which is also the case when the threshold is 5 km.

Turning to labour market outcomes, the proportion of self-employed among young females aged 13 to 25 is 2 per cent for the treatment group and 1 per cent for the control group, while that for males in the same age range is 42 per cent for the treatment group and 37 per cent for the control group when the threshold is 2 km. The proportion of the wage employment for females aged 13 to 25 is less than 1 per cent for both groups, while that for young males in the same age group is 33 per cent for the treatment group and 43 per cent for the control group. In both cases, the proportion of young females in employment is very low across the country, particularly in the case of work outside the home. The proportion of the wage employment of males is statistically different, but the proportion is higher for the control group than the treatment group.

Lastly, the proportion of being married for young females aged 14 to 25 is 40 per cent for the treatment group and 38 per cent for the control group, while that for males in the same age range is 8 per cent for the treatment group and 11 per cent for the control group when the threshold is 2 km.<sup>7</sup> The difference of those variables is not statistically significant between treatment and control groups, which is also the case when the threshold is 5 km.

Moreover, we performed a balance test for underlying characteristics of the sampled households and villages at the baseline survey (see [Supplementary Materials](#)). We do not see any significant difference in individual, household, or village characteristics except for marginally statistical differences in average age and male head's educational attainment in some categories. We control for these differences in the regression analyses below.

In sum, we confirm that there was no statistically significant difference in outcome variables except the wage employment of males in the case of the threshold of 5 km between the treatment and control groups. Regarding the covariates, household and village characteristics at the baseline are reasonably balanced, while some individual characteristics differ between the treatment and control groups that we control in the regression analyses below.<sup>8</sup>

#### **4. Empirical strategy**

This study employs a DID approach to estimate the impact of the project. The central assumption for the DID methodology to be valid is the 'parallel trend'. We assume that any change between baseline and end-line surveys without the intervention caused by unobserved characteristics is common between the treatment and control groups. We confirmed that the observed characteristics were not biased at the baseline survey, showing that people in both groups lived in similar circumstances before the project started.



We examine the impact of the rural road improvement project on the outcome variables. The basic specification is as follows:

$$Y_{ijt} = \beta_0 + \beta_1 \cdot t + \beta_2 \cdot S_j + \beta_3 \cdot (S_j \cdot t) + \epsilon_{ijt} \quad (1)$$

where:  $i$  refers to an individual,  $j$  points to a village, and  $t$  is time ( $t=0$  for baseline and  $t=1$  for end-line).  $Y_{ijt}$  is the dependent variable and takes several forms. The first three are related to schooling outcomes and the latter two are employment outcomes. All of them are binary. For educational outcomes,  $Y_{ijt}$  is a binary variable (a) to take 1 if a youth attends school and 0 otherwise, (b) to take 1 if a youth completed primary education and 0 otherwise, and (c) to take 1 if a youth has ever attained secondary or above education and 0 otherwise. For labour outcomes,  $Y_{ijt}$  is a binary variable to take the value of 1 if a youth is self-employed and 0 otherwise, and to take the value of 1 if a youth is employed with wages and 0 otherwise. We also take marital status to take 1 if married and 0 otherwise as the dependent variable.

Turning to the right-hand side variables,  $S_j$  is a binary variable that takes the value 1 for the treatment group and 0 for the control group.  $\beta_0$  to  $\beta_3$  are the parameters to be estimated.  $\beta_3$  is the parameter of our interest and measures the impact of the project on the outcomes.  $\epsilon_{ijt}$  is an iid error term. We employ an ordinary least squared (OLS) estimation to obtain the coefficients. Since the dependent variables are binary, our specification is a linear probability model (LPM).

The parallel trend assumption in the DID methodology may be violated if changes in covariates are not common between the treatment and control groups. Thus, we also employ an empirical model with some covariates. The covariates take four forms:  $X_{1ijt}$  comprises age cohort dummies (individual characteristics) and  $X_{2ijt}$  is a vector to include the characteristics of male heads/spouses and female spouses as well as a set of household characteristics such as household size, ratio of dependents to household size and holding of agricultural land. PDSI (Palmer Drought Severity Index, see [Supplementary Materials](#)) (12-month average before the survey month) is also included to capture environmental conditions for labour market outcomes. Moreover, we include  $X_{jt}$ , a vector containing a set of time-variant village  $j$ 's characteristics. Lastly,  $\mu_j$  is a dummy variable to indicate village-level fixed effect to capture village  $j$ 's time-invariant characteristics. By adding those covariates, we write another version of our empirical model:

$$Y_{ijt} = \beta_0 + \beta_1 \cdot t + \beta_2 \cdot S_j + \beta_3 \cdot (S_j \cdot t) + X_{1ijt}\gamma_1 + X_{2ijt}\gamma_2 + X_{jt}\gamma_3 + \mu_j + \epsilon_{ijt} \quad (2)$$

where the notations are the same as in Equation (1) except that  $\gamma_1$  to  $\gamma_3$  are vectors of the parameters to be estimated.

All the regression models in the following section control for the covariates at the individual, household, and village level as well as with village-level fixed effects. All standard errors are clustered at the village level.

## 5. Empirical results

**Table 2** reports the estimation results on primary and secondary school attendance for youth aged 7 to 18. The parameter of interest is the coefficient on the interaction term between the treatment group dummy and the year 2017 (end-line) dummy. Columns (A) and (B) report the results for girls. The coefficient on the interaction term is positive but not significant in Column (A), but it is positive and significant in Column (B), suggesting that the rural road development project enhances school attendance significantly by 9.1 percentage points for girls. The coefficient on the interaction terms is positive but not significant for boys, as reported in Columns (C) and (D). These results indicate that road improvement might encourage school attendance for girls but not for boys in the age group.

**Table 2.** Impact on school attendance

| Dependent variable: school attendance (=1) | Female youths aged 7 to 18        |                                   | Male youths aged 7 to 18          |                                   |
|--------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                                            | Treatment<br>(within 2 km)<br>(A) | Treatment<br>(within 5 km)<br>(B) | Treatment<br>(within 2 km)<br>(C) | Treatment<br>(within 5 km)<br>(D) |
| <i>Treatment and year dummy variables</i>  |                                   |                                   |                                   |                                   |
| Treatment * year 2017 (=1)                 | 0.044<br>(0.056)                  | 0.091*<br>(0.049)                 | 0.067<br>(0.059)                  | 0.047<br>(0.052)                  |
| Year 2017 (=1)                             | 0.044<br>(0.047)                  | 0.003<br>(0.043)                  | -0.083<br>(0.050)                 | -0.076<br>(0.047)                 |
| <i>Age cohort fixed effects</i>            | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Male headspouse characteristics</i>     | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Female spouse characteristics</i>       | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Household characteristics</i>           | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village characteristics</i>             | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village fixed effects</i>               | Yes                               | Yes                               | Yes                               | Yes                               |
| R sq.                                      | 0.457                             | 0.443                             | 0.400                             | 0.385                             |
| No. of observations                        | 1042                              | 1291                              | 1080                              | 1340                              |

Note: Village-level cluster-adjusted standard errors are in parentheses: \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.

**Table 3.** Impact on primary school completion

| Dependent variable: primary completion (=1) | Female youths aged 13 to 25       |                                   | Male youths aged 13 to 25         |                                   |
|---------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                                             | Treatment<br>(within 2 km)<br>(A) | Treatment<br>(within 5 km)<br>(B) | Treatment<br>(within 2 km)<br>(C) | Treatment<br>(within 5 km)<br>(D) |
| <i>Treatment and year dummy variables</i>   |                                   |                                   |                                   |                                   |
| Treatment * year 2017 (=1)                  | 0.006<br>(0.087)                  | 0.057<br>(0.082)                  | -0.039<br>(0.123)                 | -0.026<br>(0.105)                 |
| Year 2017 (=1)                              | 0.301***<br>(0.062)               | 0.249***<br>(0.065)               | 0.168<br>(0.105)                  | 0.168*<br>(0.097)                 |
| <i>Age cohort fixed effects</i>             | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Male headspouse characteristics</i>      | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Female spouse characteristics</i>        | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Household characteristics</i>            | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village characteristics</i>              | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village fixed effects</i>                | Yes                               | Yes                               | Yes                               | Yes                               |
| R sq.                                       | 0.386                             | 0.377                             | 0.298                             | 0.308                             |
| No. of observations                         | 488                               | 620                               | 544                               | 676                               |

Note: Village-level cluster-adjusted standard errors are in parentheses: \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.

Table 3 shows the estimation results of primary school completion for youth aged 13 to 25. The coefficient on the interaction term of the interest is not significant for girls regardless of the threshold of the treatment group (2 or 5 km). This is also the case for boys. The coefficient on the interaction term is not significant for boys either. These results reveal that road improvement did not stimulate primary school completion for either girls

**Table 4.** Impact on secondary school or above attainment

| Dependent variable: some secondary or above (=1) | Female youths aged 13 to 25 |                             | Male youths aged 13 to 25   |                             |
|--------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                                                  | Treatment (within 2 km) (A) | Treatment (within 5 km) (B) | Treatment (within 2 km) (C) | Treatment (within 5 km) (D) |
| <i>Treatment and year dummy variables</i>        |                             |                             |                             |                             |
| Treatment * year 2017 (=1)                       | 0.102**<br>(0.044)          | 0.076*<br>(0.040)           | 0.024<br>(0.062)            | 0.029<br>(0.057)            |
| Year 2017 (=1)                                   | 0.084***<br>(0.029)         | 0.085***<br>(0.026)         | 0.050<br>(0.054)            | 0.046<br>(0.052)            |
| <i>Age cohort fixed effects</i>                  | Yes                         | Yes                         | Yes                         | Yes                         |
| <i>Male headspouse characteristics</i>           | Yes                         | Yes                         | Yes                         | Yes                         |
| <i>Female spouse characteristics</i>             | Yes                         | Yes                         | Yes                         | Yes                         |
| <i>Household characteristics</i>                 | Yes                         | Yes                         | Yes                         | Yes                         |
| <i>Village characteristics</i>                   | Yes                         | Yes                         | Yes                         | Yes                         |
| <i>Village fixed effects</i>                     | Yes                         | Yes                         | Yes                         | Yes                         |
| R sq.                                            | 0.252                       | 0.294                       | 0.246                       | 0.256                       |
| No. of observations                              | 1063                        | 1355                        | 1203                        | 1472                        |

Note: Village-level cluster-adjusted standard errors are in parentheses: \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.

or boys. Those results are natural because most primary schools that students attend are located near each household and most students do not use road transportation to commute to their schools. We note that the coefficient of the year dummy for girls is largely positive and statistically significant at the one percent level, reflecting a series of government policy measures to promote girls' education.<sup>9</sup>

Table 4 shows the estimation results of having ever attained secondary school education or above for youth aged 13 to 25. The coefficient on the interaction term of interest is positive and significant for girls. The coefficient is 0.102 in Column (A), showing that the rural road development project increased the probability of having ever attained secondary education or above by 10.2 percentage points. The positive coefficient is comparable at 0.076 (7.6 percentage points) if we take a threshold of 5 km to reach treatment roads (Column (B)). In contrast, the corresponding coefficient for boys is positive but much smaller and imprecisely estimated, indicating the rural road improvement did not increase the probability of ever attaining secondary education or above of males. The coefficient of the year dummy for girls is positive and significant for the same reason ascribed to Table 3.

We find that the rural road improvement encouraged youth to pursue substantially better educational attainment by around 10 percentage points only for girls but not for boys, given that males' education attainment was much higher than females at the baseline survey. The clear gender gap in the impact of road improvement on completion of higher schools may reflect the lower completion rate of higher schools for young females; the proportion of secondary school or above attainment for girls is about 10–14 per cent at the baseline. While most primary schools are located within walking distance of their houses, and road improvement is less relevant to primary school attendance, most students need road transportation to commute to secondary schools or above. Thus, rural road improvement reduces the travel time and costs of commuting to school and provides a wider range of options for transportation, which contributes to the higher rate of completion in higher education.

**Table 5.** Impact on self-employment

|                                           | Female youths aged 16 to 25       |                                   | Male youths aged 16 to 25         |                                   |
|-------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Dependent variable: self-employment (=1)  | Treatment<br>(within 2 km)<br>(A) | Treatment<br>(within 5 km)<br>(B) | Treatment<br>(within 2 km)<br>(C) | Treatment<br>(within 5 km)<br>(D) |
| <i>Treatment and year dummy variables</i> |                                   |                                   |                                   |                                   |
| Treatment * year 2017 (=1)                | −0.002<br>(0.014)                 | 0.005<br>(0.015)                  | −0.007<br>(0.064)                 | 0.020<br>(0.064)                  |
| Year 2017 (=1)                            | 0.026<br>(0.037)                  | 0.019<br>(0.031)                  | −0.240*<br>(0.138)                | −0.254*<br>(0.132)                |
| <i>Age cohort fixed effects</i>           | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Male headspouse characteristics</i>    | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Female spouse characteristics</i>      | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Household characteristics</i>          | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village characteristics</i>            | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village fixed effects</i>              | Yes                               | Yes                               | Yes                               | Yes                               |
| R sq.                                     | 0.152                             | 0.120                             | 0.272                             | 0.281                             |
| No. of observations                       | 969                               | 1246                              | 983                               | 1204                              |

*Note:* Village-level cluster-adjusted standard errors are in parentheses: \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.

In contrast, we do not see any positive impact on schooling outcomes for young males, partly because the completion rate of higher education was higher than that of girls, and there was less room for them to increase. In the aspect of school attainment, rural road improvement did not benefit young females and males evenly, and it might be tempting to conclude that the road project did not alter the behaviour of young males. However, the little impact on schooling does not mean that paved roads did not affect young males.

Now, we turn to labour market outcomes for youth. Table 5 reports the estimation results of the impact on self-employment. For young females, the coefficient on the interaction term between the treatment group dummy and the end-line year dummy is insignificant. Similarly, for young males, the coefficient is not significant. These results indicate that rural road improvement did not stimulate self-employed work in rural areas for either young females or males.

Table 6 shows the estimation results of the impact on wage employment. The upper part finds that the coefficient on the interaction term is small and insignificant for young females. In contrast, the coefficient is positive and statistically significant for young males. Column (C) shows that rural road improvement increased wage employment by 10.9 percentage points. The point estimate is similar at 0.110 (11.0 percentage points) in Column (D). These results demonstrate that rural road improvement increased paid jobs for young males, but the positive impact is not found for young females.

## 6. Further analyses

We turn to further analyses.<sup>10</sup> First, we considered the distance from each household to a paved (treatment) road since the impact of access to paved roads may depend on the location of each household. We utilised geographical data on the location of households and paved roads to measure the distance and included an interaction term among the treatment group dummy, the end-line survey dummy, and distance to road from the household in the treatment group.

**Table 6.** Impact on wage employment

| (1) All youth aged 16 to 25                        |                                                  |                                   |                                               |                                   |
|----------------------------------------------------|--------------------------------------------------|-----------------------------------|-----------------------------------------------|-----------------------------------|
| Dependent variable:<br>wage employment (=1)        | Female youths aged 16 to 25                      |                                   | Male youths aged 16 to 25                     |                                   |
|                                                    | Treatment<br>(within 2 km)<br>(A)                | Treatment<br>(within 5 km)<br>(B) | Treatment<br>(within 2 km)<br>(C)             | Treatment<br>(within 5 km)<br>(D) |
| <i>Treatment and year dummy variables</i>          |                                                  |                                   |                                               |                                   |
| Treatment * year<br>2017 (=1)                      | 0.006<br>(0.011)                                 | 0.002<br>(0.010)                  | 0.109*<br>(0.065)                             | 0.110*<br>(0.063)                 |
| Year 2017 (=1)                                     | 0.008<br>(0.010)                                 | -0.009<br>(0.016)                 | -0.192<br>(0.125)                             | -0.150<br>(0.122)                 |
| <i>Age cohort fixed effects</i>                    | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Male headspouse<br/>characteristics</i>         | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Female spouse<br/>characteristics</i>           | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Household<br/>characteristics</i>               | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Village characteristics</i>                     | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Village fixed effects</i>                       | Yes                                              | Yes                               | Yes                                           | Yes                               |
| R sq.                                              | 0.159                                            | 0.143                             | 0.350                                         | 0.316                             |
| No. of observations                                | 969                                              | 1246                              | 983                                           | 1204                              |
| (2) Young males aged 16 to 25 by educational level |                                                  |                                   |                                               |                                   |
| Dependent variable:<br>wage employment (=1)        | Male youths aged<br>16 to 25 (primary education) |                                   | Male youths aged<br>16 to 25 (some secondary) |                                   |
|                                                    | Treatment<br>(within 2 km)<br>(A)                | Treatment<br>(within 5 km)<br>(B) | Treatment<br>(within 2 km)<br>(C)             | Treatment<br>(within 5 km)<br>(D) |
| <i>Treatment and year dummy variables</i>          |                                                  |                                   |                                               |                                   |
| Treatment * year 2017 (=1)                         | 0.092<br>(0.079)                                 | 0.098<br>(0.079)                  | 0.141<br>(0.118)                              | 0.190*<br>(0.108)                 |
| Year 2017 (=1)                                     | -0.296<br>(0.178)                                | -0.244<br>(0.177)                 | -0.029<br>(0.188)                             | -0.174<br>(0.178)                 |
| <i>Age cohort fixed effects</i>                    | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Male headspouse characteristics</i>             | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Female spouse characteristics</i>               | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Household characteristics</i>                   | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Village characteristics</i>                     | Yes                                              | Yes                               | Yes                                           | Yes                               |
| <i>Village fixed effects</i>                       | Yes                                              | Yes                               | Yes                                           | Yes                               |
| R sq.                                              | 0.441                                            | 0.408                             | 0.425                                         | 0.410                             |
| No. of observations                                | 644                                              | 787                               | 339                                           | 417                               |

Note: Village-level cluster-adjusted standard errors are in parentheses: \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.

We confirmed that our estimation results are not largely altered and that the impact is less affected by the distance to the paved roads in the treatment group.

Second, we incorporated the duration in service of each treatment road since the time of completing construction differs between roads. We included interaction terms among the treatment group dummy, the end-line survey dummy, and each of the three-year dummies of completion of a treatment road (year = 2013, 2014, or 2015). For female educational attainment for secondary high school or above, the magnitude of the coefficients of the three interaction terms is comparable, and only the interaction term, including the year 2014 dummy, is statistically significant in both thresholds. For male wage employment, most of the interaction terms are positive, with the year 2013 dummy the largest in magnitude and statistically significant, implying that earlier completion of the road benefits potential wage earners more in later periods.

Third, we adjusted the threshold to distinguish between the treatment and control groups other than 2 and 5 km (that is, 3 km and 4 km) and confirmed that the main results are unchanged.

## 7. Discussion

Our findings uncover a sharp gendered impact resulting from the rural road improvement project, motivating higher education for females and paid work for males. Previous literature revealed significant impacts of road pavement on education and employment with heterogeneity across ages. Adukia et al. (2020) find that road construction did not have positive effects on primary school children but significantly increased middle school enrolment in India for both girls and boys.<sup>11</sup> Aggarwal (2018) reports that paved roads improved school enrolments for younger children and pulled teenage family members out of school to join the labour force in India – the case for both genders.

In the case of rural Morocco, young males are more likely to get a paid job easily, thanks to the road improvements. However, this does not necessarily mean a trade-off between a higher level of schooling and immediate employment opportunities. To investigate this aspect, we estimate the main specification on the wage employment regression focussing on the young male sample aged 16 to 25, splitting them into levels of educational attainment (primary or some secondary or above). The lower part of Table 6 shows that the coefficient on the interaction term of interest is not statistically significant for male youth with primary education but only positive and significant for males with some secondary school or above if the threshold is 5 km. Even in the case of the threshold of 2 km, the coefficient is positive and the magnitude is similar to the threshold of 5 km. Hence, the improved rural roads encourage relatively more educated males to find wage employment opportunities.<sup>12</sup> We confirmed that, while most of the individuals in the sample speak the local Amazigh language as their mother tongue, the most popular occupation types for young males require proficiency in Arabic or French (for example, construction and manufacturing workers, or employees repairing cars or motorbikes). This may explain why rural road improvement is suitable for the wage employment of better educated young males. The high unemployment rate among the better educated younger generation may also partially discourage young males from pursuing a higher level of education and motivate them to work for a wage instead.

Compared to males, under conservative social norms related to Muslim traditions, young females are restricted from entering the labour market outside of their households even when they attain a higher level of education. We find that young females are more motivated to complete higher (secondary or above) education following the rural road improvement, which reduces the travel time and costs of commuting to school and provides a wider range of options for transport. At the same time, we find suggestive evidence that early marriage among young females decreased in the treatment group.<sup>13</sup> Table 7 shows the impact of improved rural roads

Table 7. Impact on marriage

|                                             | Female youths aged 14 to 25       |                                   | Male youths aged 14 to 25         |                                   |
|---------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Dependent variable:<br>marriage (=1)        | Treatment<br>(within 2 km)<br>(A) | Treatment<br>(within 5 km)<br>(B) | Treatment<br>(within 2 km)<br>(C) | Treatment<br>(within 5 km)<br>(D) |
| <i>Treatment and year dummy variables</i>   |                                   |                                   |                                   |                                   |
| Treatment * year<br>2017 (=1)               | −0.106**<br>(0.053)               | −0.081*<br>(0.045)                | −0.065<br>(0.043)                 | −0.046<br>(0.042)                 |
| Year 2017 (=1)                              | 0.039<br>(0.092)                  | 0.022<br>(0.082)                  | 0.088<br>(0.089)                  | 0.089<br>(0.086)                  |
| <i>Age cohort fixed effects</i>             | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Male head/spouse<br/>characteristics</i> | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Female spouse<br/>characteristics</i>    | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Household<br/>characteristics</i>        | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village characteristics</i>              | Yes                               | Yes                               | Yes                               | Yes                               |
| <i>Village fixed effects</i>                | Yes                               | Yes                               | Yes                               | Yes                               |
| R sq.                                       | 0.424                             | 0.419                             | 0.206                             | 0.196                             |
| No. of observations                         | 1140                              | 1456                              | 1167                              | 1430                              |

Note: Village-level cluster-adjusted standard errors are in parentheses: \*significant at 10 per cent, \*\*significant at 5 per cent, \*\*\*significant at 1 per cent.

on the probability of marriage among young females, which includes those who had migrated out at the end-line survey.<sup>14</sup> We use the same specification as our main specification (Equation (2)), replacing the dependent variable with a binary to take 1 if married and 0 otherwise. The coefficients on the interaction term of interest in Columns (A) and (B) are negative and statistically significant. Hence, the higher educational attainment of young females might coincide with the decrease in early marriage. The coefficient is not significant for boys. Assaad and Krafft (2015) show that assortative mating in terms of education is likely to be at work in the marriage market in Morocco: there is a clear pattern of trade-offs between women's education and later marriages for higher educated men. Such underlying mechanisms could be at work in the marriage market to explain our findings.

The findings of this study could be situated in gender studies, particularly in regard to gender identity. Butler (1990) argues that gender identities have come to be considered as fluid in some societies and are always being constructed even in patriarchal societies. Our study rests on an influential work by Naila Kabeer, who defines gender empowerment as the process by which women who have traditionally been denied the ability to make choices to 'acquire ability', thus gaining power in their household and community relationship (Kabeer 1999). A growing number of studies have revealed that advancing women's empowerment in only a few aspects, particularly in patriarchal societies, is not sufficient to eliminate gender inequality (for example, Kumar, Raghunathan, Arrieta, Jilani, and Pandey (2021) and Sato, Shimamura, and Lastarria-Cornhiel (2022) for self-help group in India). In the context of Morocco, Boutouba (2014) examines gender troubles by the New Family Code Reform (Moudawana) in 2004 described in a film, which has enhanced women's status and challenged traditional views and constructions of gender roles. Naji (2009) highlighted the significant role of body techniques in the material process of socialisation and subject construction focussing on weaving in Southern Morocco. This paper shows rural road improvement led to enhanced female educational attainment, but they have no other option other than to seek higher educated males in the marriage market in Morocco.



Those papers reveal that gender identities are constructed by a variety of factors such as law, technology, and infrastructure, which calls for a subtle investigation in future.

## 8. Conclusion

This paper examines the impact of a rural road improvement project on schooling decisions and youth employment in Morocco. We find contrasting results between young females and males. First, we find a positive and significant effect on secondary school attainment or above only for females. Higher educational attainment is associated with a lower proportion of early marriages. Second, we observe a positive and significant effect on wage employment only for males. Our findings reveal a sharp gender difference in the impact of the rural road improvement project, which motivates better education for females and paid work for males.

Our results show that the impact of an infrastructure improvement project may be heterogeneous between young females and males. Thus, we argue that not only the total impact but also the gendered impact should be considered in policymaking. The contrasting impact revealed in this study was made possible by rich longitudinal household-level data. Future research should address the impact of infrastructure using micro-level data to reveal heterogeneous effects across different beneficiaries with different characteristics, which are not limited to gender. Such efforts are essential to understand the gradation of the total impact – largely neglected in previous studies – by identifying the full range of beneficiaries and exploring whether road infrastructure has contributed to reducing inequality and poverty.

## Notes

1. See <https://rai.azavea.com/>.
2. For example, increases in schooling and reductions in child labour were achieved in areas with employment concentrated in industries losing tariff protection in India (Edmonds, Pavcnik, & Topalova, 2010). Districts with lower costs of learning English benefitted more from globalisation in India (Shastri, 2012).
3. See Hine, Abedin, Stevens, Airey, and Anderson (2016) for a systematic survey on the impact of rural road extension.
4. At the beginning of the 2010s, the public roads in Morocco consisted of highways (1.6 per cent), national roads (18.3 per cent), state roads (17.6 per cent), and prefectural roads (62.5 per cent). In addition to public roads, 'not-classified roads' concentrated in rural areas play an important role in rural transportation (JICA, 2011). Accessibility to rural roads is defined as the proportion of the rural population who live in 'douars' (villages) of at least 50 households located within 1 km from an all-weather road.
5. The data are available from UNESCO Institute of Statistics (<http://uis.unesco.org/country/MA>). During the same period, the gross enrolment ratio increased from 110.7 in 2011 to 114.76 in 2019 with a higher ratio for boys. The gross enrolment ratio for secondary education was 66.5 per cent in 2011, which increased to 81.2 per cent in 2019 and the rate was consistently higher for boys.
6. The Rural Road Improvement Project I financed the construction of 67 sections in 9 provinces with a total length of approximately 835km between 2008 and 2015. The program of the National Rural Roads Plan II was financed by the World Bank, African Development Bank, European Investment Bank, French Development Agency, and JICA. A detailed description of the background for the JICA project is available in JICA (2019).
7. While the minimum marital age is 18 for both sexes, child marriage is prevalent in the country, corresponding to 11 per cent of the total number of marriages in 2013 and considered to be underreported (LANDINFO, 2017).
8. In our dataset, transportation options for schooling are diverse and include both private and public transportation methods. The majority commute on foot, while others use a bicycle/motorbike/vehicle that is privately owned. Some public transportation options are available, such as a taxi service by vehicle or motorbike. The use of regular public buses for schooling is rare. Instead, they use school buses to commute, especially in the case of secondary schooling.
9. In 2006, the government enacted the 'National Strategy for Gender Equality', providing a practical approach to the reduction of gender disparities in all sectors and seeking to promote girls' education and women's rights to counter the multiple inequalities they experience. Subsequent to this strategy, a new program, the 'National Strategy for Equity and Equality', was adopted for the period 2012–2016. It includes equal access to education as one of the eight pivotal areas (Boutieri, 2016).
10. All the results in this section are available upon request from the authors.

11. Adukia et al. (2020) also found that school performance improved, but we do not examine this due to a lack of performance data.
12. This 'complementarity' between schooling and roads is consistent with the case of rural Indonesia (Yamauchi, Muto, Chowdhury, Dewina, & Sumaryanto, 2011).
13. Early marriage is a policy issue for the younger generation in Morocco (UNICEF, 2011).
14. Marriage involves separation from the original household, especially for females in Morocco. The end-line data include the data from the phone tracking survey for individuals who have separated from the original household to track individuals who have separated from their households.

## Acknowledgments

This study was conducted as part of the project 'Empirical Research in Africa' at the JICA Ogata Sadako Research Institute for Peace and Development. The data used in this study were collected by the Evaluation Department of JICA. The program code is available upon a reasonable request. We thank the Evaluation Department and JICA Ogata Institute for allowing us to use the data for this study. We also appreciate the cooperation from JICA Morocco Office in assisting with data collection, especially from Ryoma Harasawa, Khadija Kili, and Ayman Hafid as well as Etsuko Masuko and Shimpei Taguchi for their constructive comments on the draft. The views expressed in the paper are those of the authors and do not represent the official positions of either the JICA Ogata Sadako Research Institute for Peace and Development or JICA. The authors are responsible for any errors or omissions.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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